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(71) Applicant
Tadashi Kadota,
3–35 Nichimachi 1-chome, Kokubunji-shi, Tokyo, Japan

(72) Inventor
Tadashi Kadota

(74) Agent and/or Address for Service
Marks & Clerk,
57–60 Lincoln's Inn Fields, London WC2A 3LS

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(54) Splice sleeve for reinforcing bars

(57) In a building construction using precast reinforced concrete blocks, the reinforcing bars 20,29 of an upper block are connected to and aligned with the reinforcing bars of a lower block by introducing grouting into a splice sleeve which has an integral, elongated shell 10 whose internal surface has annular ridges 16 to grip the grouting. In order to align the shell 10 properly with the upper bar 20, the internal surface of the sleeve has a central, radially-inwardly-projecting part 15. In order to seal the upper end of the sleeve and prevent ingress of concrete when casting, the shell 10 has an upper annular projection 21 which extends upwards from its upper end surface 25 to define an upper recess 30 for receiving a flexible, plastics sealing member 23; inwardly-projecting parts 22 prevent the removal of the sealing member 23. The sealing member 23 has a central hole which fits closely against the upper bar 20. To prevent joint mortar from entering the shell 10 through its lower opening 12, there is a lower, radially-inward annular projection 26.

FIG. 1

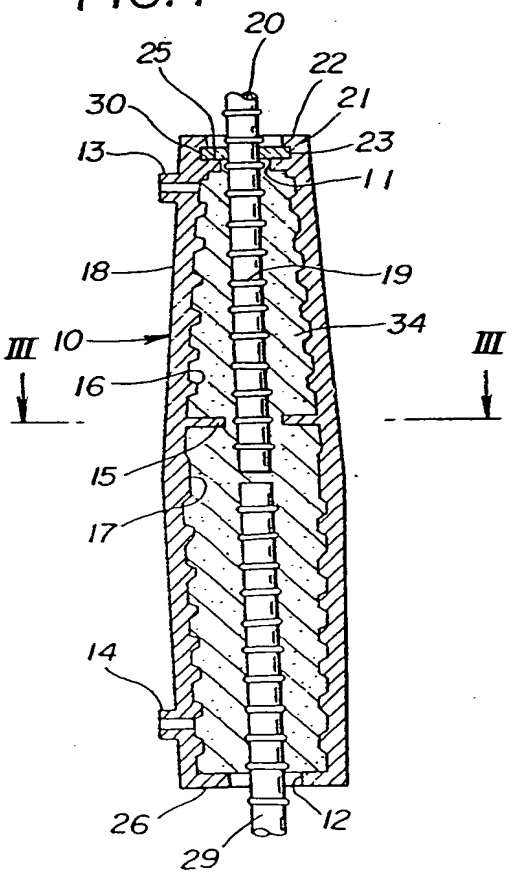

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FIG. 1

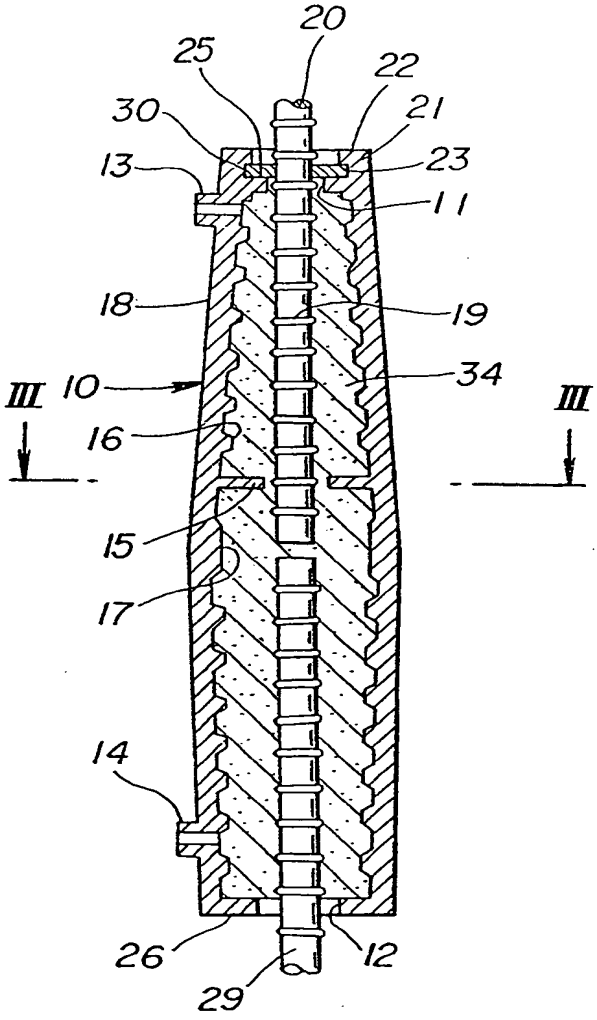

FIG. 2

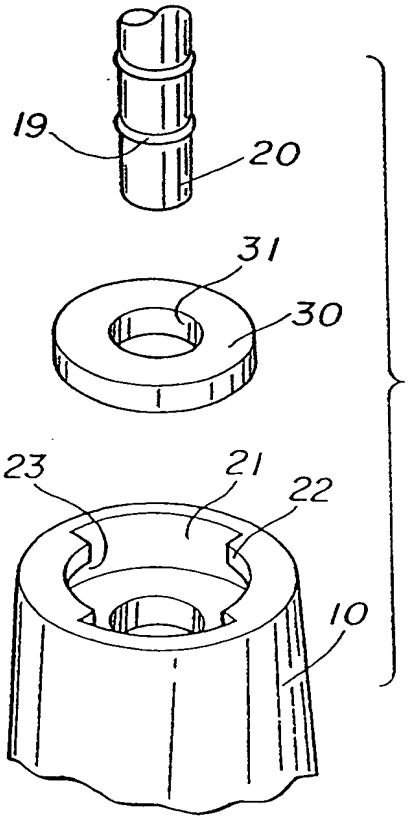

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FIG.3

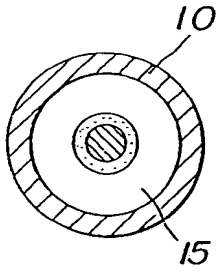


FIG.4

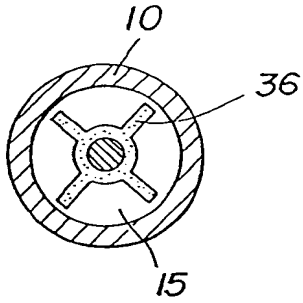


FIG.5

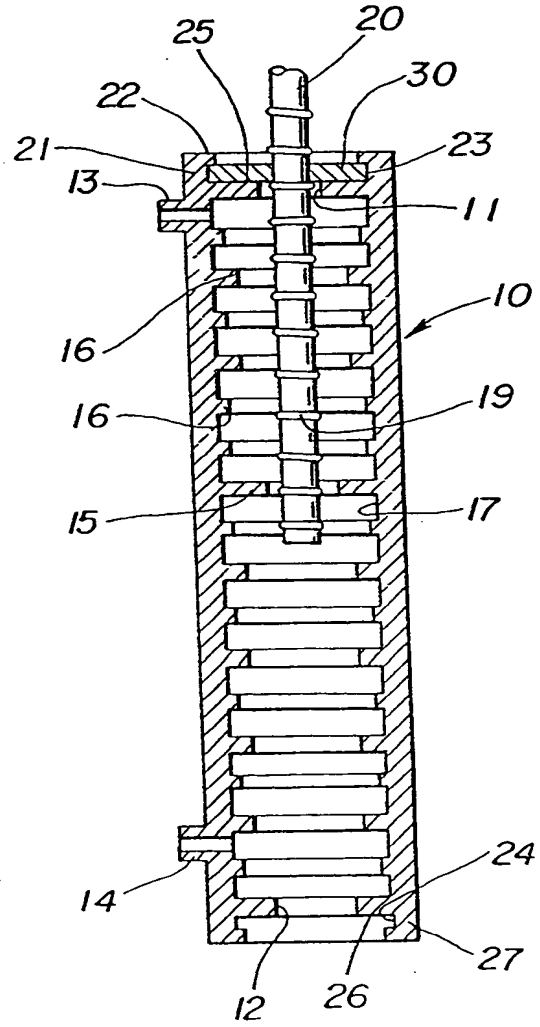


FIG.7

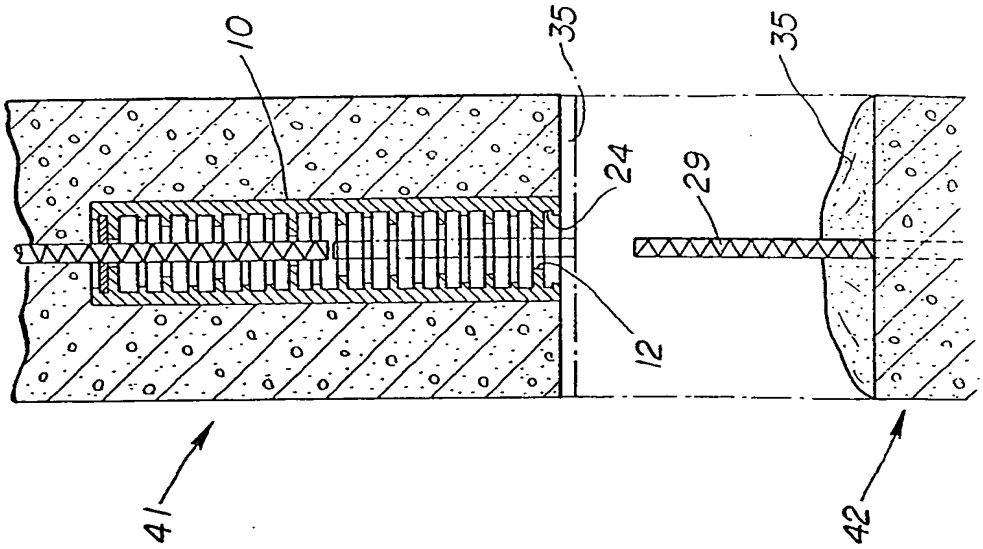
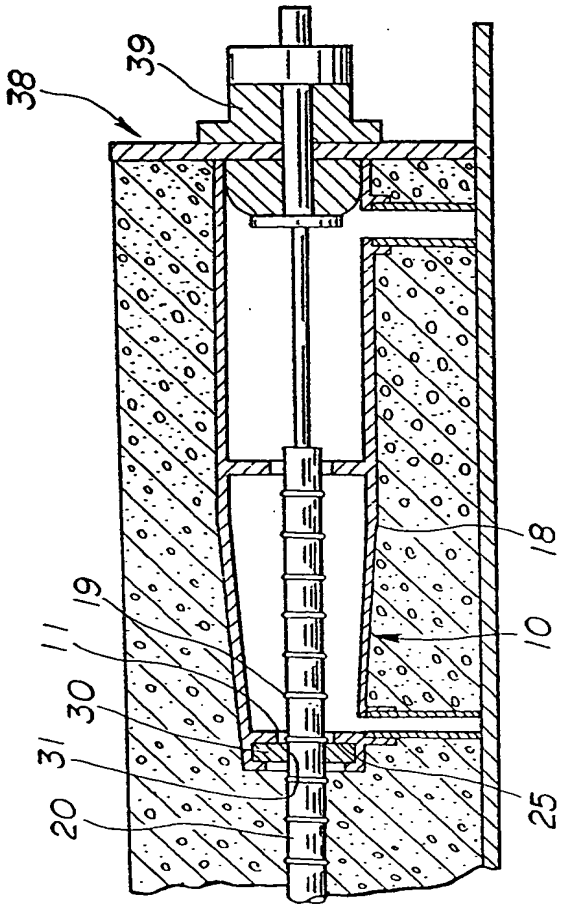


FIG.6



SPECIFICATION

Splice sleeve for reinforcing bars

Background of the Invention

Field of the invention.

The present invention relates to a mortar grout sleeve splice for reinforcing bars utilized in concrete wall structures, and more particularly to a splice sleeve having a generally cylindrical shell whose interior surface is usually provided with annular ridges, the annular space between the interior of the sleeve and the exterior of the reinforcing bars being filled with grouting for connecting and generally aligning the opposite ends of the reinforcing bars.

Prior art.

U.S. 4 627 212 discloses a splice sleeve having a cylindrical shell of which the internal surface is formed with annular ridges progressively increasing in their radially inwards projection from the central or innermost ridges toward the two end surfaces, each of which has an opening receiving a respective reinforcing bars—thus the holes defined by the ridges progressively increase in diameter from the openings towards the central ridges. The shell is formed with a pair of vent and grout-injection ports projecting from the external cylindrical surface. The upper reinforcing bar passes through the holes defined by the annular ridges, its end being within the central hole. The relatively large central hole allows the end portion of the upper reinforcing bar to deviate from the axis of the splice sleeve and, sometimes, come too near to or too distant from the vent port.

This sleeve has its upper end surface covered by a rubber cap prior to being placed in a mold form. The end of the upper reinforcing bar is inserted into the upper opening of the shell through a top hole in of the cap and the bar is then positioned in the mold, which is then filled with concrete except the inside space of the splice sleeve, to fabricate a concrete wall structure or block. In addition to the top hole, the cap is formed with a side hole to be fitted on the vent port projecting from the cylindrical surface of the shell. The concrete in the mold is compacted by a concrete vibrator prior to hardening. The vibration compacting would cause the cap to come off the shell if the side hole is not fitted on the vent port. However, it is not easy to stretch the cap to the extent that the side hole is fitted on the vent port. The boss portion around the top hole of the cap is bound to the reinforcing bar with wires while the bottom peripheral portion of the cap is adhesive taped to the external surface of the shell to allow no gap between the top hole and the reinforcing bar nor any clearance between the cap and the prepare caps for every sleeve size. Besides, the rubber cap does not so fit the ribs of the reinforcing bar as to leave no gap therebetween, sometimes permitting the concrete to penetrate into the shell and reduce the splicing strength of the sleeve. Another disadvantage is that the rubber cap prevents the exterior surface of the sleeve from being fully concreted, thereby reducing the cross-sectional area of the concrete wall structure or making a weak point or cavity in the concrete wall structure.

A further disadvantage is that the end of the reinforcing bar in the splice sleeve easily moves from the center of the splice sleeve during the vibration compacting, so that the precast concrete wall structure sometimes fails due to the excessive deviation between the axes of the reinforcing bar and the splice sleeve. The end portion of the reinforcing bar, if inclined too near to the vent port, will cause air to remain within the sleeve and prevent the injection of mortar grout into the shell. If it is inclined too far from the vent port the grout will flow out of the vent port without filling up the inside of the shell. When upper and lower precast concrete walls are joined to each other, a washer is always attached to the upper end of the reinforcing bar projecting from the lower wall to prevent the joint mortar between the walls penetrating into the inside of the sleeve. However, it is troublesom to attach the washer to the upper end of each reinforcing bar.

Summary of the Invention

The present invention provides splice sleeves as set forth in Claims 1 or 9, a concrete building member as set forth in Claim 10 and methods as set forth in Claims 11 or 12. The remaining Claims set forth optional features of the invention.

In preference, the sealing member is made from a foam resin or plastics material, particularly a stiff foam or board such as a foamed polystyrene or the like, and shaped in the form of a hollow disk. Without requiring an external cap, the sealing member protects the inside of the shell against the penetration of the concrete during the vibration compacting when the reinforced concrete wall structure, block, or the like is precast. The sealing member built into the shell produces no weak point like a cavity in the precast concrete structure, because the external surface of the shell is fully concreted irrespective of the sealing member. The central, radially-inwardly projecting part prevents the end of the upper reinforcing bar from deviating excessively from the center of the shell with the result that the axes of the shell and the reinforcing bar are always substantially aligned. It is preferable to have an annular projection extending radially inwards on the lower end portion of the shell

shell when the lower reinforcing bar is inserted into the lower opening to join the lower precast structure with the upper one, without having to place a washer on the lower bar.

The advantages offered by the invention are mainly that the sealing member is preliminarily built into the sleeve to prevent concrete penetrating into the sleeve when the reinforced concrete structure is molded. The sealing member can be made from a flexible material and shaped in the form of a hollow disk, thereby being easy to mount within the annular recess in the shell. The sealing member can be formed with a central hole closely fitting the ribs, or the part between the ribs, of the reinforcing bar. The exterior surface of the sleeve can be fully concreted without producing a weak point like a cavity nor reducing the cross-sectional area in the precast concrete wall structure or the like. The effective length of the sleeve is increased to receive the sealing member and increase the strength of the precast concrete structure. The central, radially-inwardly projecting part ensures that the precast concrete wall structure is molded to have the reinforcing bars axially aligned with the sleeves. The splice sleeve of the invention does not require the known expensive and troublesome rubber cap.

PREFERRED EMBODIMENTS

The invention will be further described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a longitudinal sectional view of a splice sleeve of the invention, also showing its upper and lower reinforcing bars and grouting;

Figure 2 is a perspective view, on an enlarged scale, of the upper end portion of the splice sleeve and of the sealing member to be mounted in the recess in the end portion;

Figure 3 is a cross-section along the line III-III of Figure 1, illustrating the relationship of the innermost or central ridge of the splice sleeve to the upper reinforcing bar;

Figure 4 is a view similar to Figure 3, of another embodiment;

Figure 5 is a longitudinal, sectional view of a further embodiment of the invention in which recesses are formed in the both end portions of the sleeve;

Figure 6 is a sectonal view of the relevant portion of the reinforced concrete wall structure, being cast in the mold form; and

Figure 7 is a sectional view of the upper and lower precast concrete wall structures which are to be joined with each other.

Referring now to Figure 1, the splice sleeve of the invention has a one-piece shell 10 constructed of metal, such as ductile cast iron or the like. The shell 10 has a somewhat spindle-like configuration of which the upper half is frustoconical, the lower half being cylindrical. of shell 10 are each provided with upper and lower openings 11 and 12, the upper opening 11 having a smaller diameter than the lower. The upper opening 11 receives the end portion of an upper reinforcing bar 20 when the reinforced concrete wall structure is cast. The lower opening 12 receives the end portion of a lower reinforcing bar 29 projecting from a non-illustrated lower concrete wall structure when the upper and lower concrete wall structures are joined to each other. The external surface 18 of the upper half of the shell 10 is provided with a vent port 13 which is of smaller diameter than a grouting port 14 in the external surface 18 of the lower half so that grout 34 entering the larger port 14 will completely fill the cavity due to the restricted discharge. The shell 10 has an annular projection 21 extending longitudinally from the upper end surface 25 to form an upper recess 23 outside the upper opening 11. The upper annular projection 21 has parts projection radially inwardly to form a pair of arcuate edges 22 (see Figure 2). Before casting, a sealing member 30 is mounted in the upper recess 23 to tightly fit on the upper reinforcing bar 20.

Referring to Figure 2, the arcuate edges 22 are diametrically disposed on the very top end of the annular projection 21 of the shell 10. The sealing member 30 is a hollow disk having an outer diameter similar to or slightly less than the inner diameter of the recess 23. The sealing member 30 has a central hole 31 whose inner diameter is similar to or slightly less than the outer diameter of the reinforcing bar 20, between ribs 19. The sealing member 30 is made from a material that is flexible and resists concreting. For example, it may be made from a light, inexpensive plastic board, such as a foamed polystyrene board or the like. The sealing member is resiliently bent to pass the edges 22 and then put in the recess 23. Once the sealing member 30 is set in the recess 23, the edges 22 prevent it from removal from the recess 23. The sealing member 30 is easily placed in the recess 23 and fits well against the reinforcing bar 20, leaving no gap between the inner surface of the central hole 31 and the external surface, between ribs 19, of the reinforcing bar 20.

As seen in Figure 1, the shell internal surface 17, in the central portion of the sleeve, is formed with a radially-inwardly projecting part or central ridge 15 which projects radially inwards more than other ridges 16. The central ridge 15 is a hollow circular ring with or without radial slits 36, as seen in Figures 3 and 4. The ridges 15 and 16 together with ribs 19 on the reinforcing bar 20 provide a very secure and rigid bond and interaction between the grout 34, the reinforcing bar 20 and the shell 10 of the splice sleeve. The central ridge 15 defines a hole whose inner

inner diameter of the uppper opening 11 so that the end portion of the upper reinforcing bar 20 cannot move too near to or too far from the vent port 13. If the upper reinforcing bar 20 were too near to the vent port 13, the air within the shell 10 could not get out of the vent port 13 but resist the grouting when the mortar grout is injected into the sleeve. On the other hand, if the reinforcing bar 20 were too far from the vent port 13, the grout would flow out of the vent port 13 without filling up the space diametrically opposite the vent port 13.

Referring to Figure 5, in which is shown another embodiment of the splice sleeve of the invention, the cylindrical shell 10 has upper and lower annular projections 21 and 27 extending longtudinally from the upper and lower end surfaces 25 and 26 to form upper and lower recesses 23 and 24. The internal surface 17 of the shell 10 includes a central ridge 15 and a plurality of ridges 16 which are substantially equally spaced between the upper and lower openings 11 and 12. The central ridge 15 defines a hole slightly larger in diameter than the reinforcing bar 20 so that the shell 10 and the reinforcing bar 20 are axially aligned with each other. The ridges 16 project radially inwards from the internal surface 17 of the shell 10 by at least two different radial distances, and define holes whose inner diameters are different from each other but larger than that defined by the central ridge 15. The ridges 15 and 16 together with the ribs 19 on the reinforcing bar 20 provide a very secure and rigid bond and interaction between the grout, the reinforcing bar 20, and the shell 10 of the splice sleeve. The sealing member 30 is mounted in the upper recess 23 and prevented from removal by the edges 22, before the reinforcing bar 20 is inserted into the upper opening 11. The shell 10 is provided with the vent port 13 and the grouting port 14.

Referring to Figure 6, in which a reinforced concrete wall structure is shown as cast in a mold, the end portion of the reinforcing bar 20 has been inserted through the sealing member 30 and into the opening 11 of the shell 10; the shell 10 is fixed to the mold form 38 by the use of a fixing 39. The sealing member 30 has its inner diameter similar to the outer diameter of the reinforcing bar 20, between the ribs 19, so that there is no clearance between the outer surface of the reinforcing bar 20 and the inner surface of the hole 31. The concrete fills the space in the mold 38 to press the sealing member 30 against the end surface 25 of the shell 10 and seal the opening 11, without penetrating into the inside of the shell 10 when it is compacted by vibration. The shell 10 has its external surface 18 fully concreted, so that there remains no space to reduce the cross-sectional area of the precast wall structure. The sealing member 30 inside the external surface 18 of the shell 10 does not reduce the cross-sectional area of the wall but increases the effective length of the splice sleeve, thereby increasing the strength of the precast wall structure.

Referring to Figure 7, in which the upper and lower precast concrete wall structures 41 and 42 are about to be vertically joined to each other, the lower surface of the upper concrete wall structure 41 is pressed onto the joint mortar 35 on the upper surface of the lower wall structure 42. The joint mortar 35 is received in the lower recess 24 of the shell 10 in the upper concrete wall structure 41 without entering the inside of the shell 10 through the lower opening 12. This means that it is not necessary to attach a washer to the end portion of the reinforcing bar 29 projecting from the upper surface of the lower concrete wall structure 42 in order to prevent joint mortar 25 penetrating into the sleeve when the concrete wall structures are joined.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the spirit of the invention.

CLAIMS

1. A splice sleeve for connecting upper and lower reinforcing bars in a reinforced concrete construction, the sleeve comprising an integral, elongated shell having internal and external generally cylindrical surfaces and upper and lower end surfaces having respective upper and lower openings for receiving the end portions of the upper and lower reinforcing bars, the internal surface being formed with a radially-inwardly-projecting part in the central portion of the sleeve, defining a hole for receiving the endmost portion of the upper reinforcing bar, the shell having an upper annular projection extending longitudinally from its upper end surface to define an upper recess for receiving a sealing member outside the upper end surface, the annular projection being formed with a radially-inwardly-projecting part to prevent the sealing member being removed from the recess, the sealing member having a central hole which will fit closely against the side of the upper reinforcing bar.

2. The splice sleeve of Claim 1, wherein the shell is provided with a lower annular projection extending longitudinally from its lower end surface to define a lower recess for receiving joint mortar.

3. The splice sleeve of Claim 1 or 2, wherein said sealing member is made of a foam plastics board.

4. The splice sleeve of any of the preceding

Claims, wherein the internal surface is formed with a plurality of longitudinally-spaced, radially-inwardly-projecting annular ridges, each defining a hole for receiving a reinforcing bar inserted into the shell.

5. The splice sleeve of any of the preceding Claims, wherein the central radially-inwardly-projecting part is in the form of a hollow ring, with or without radial slits.

6. The splice sleeve of Claim 4 or 5, wherein said annular ridges project radially inwards from the internal surface of the shell by at least two different radial distances, both of which are smaller than that of the central radially-inwardly-projecting part.

7. The splice sleeve of any of the preceding Claims, wherein the shell is composed of a cylindrical lower portion, and an upper portion tapering frustconically upwards from the lower portion.

8. The splice sleeve of any of the preceding Claims, wherein the central radially-inwardly-projecting part has an inner diameter slightly larger than the outer diameter of the upper reinforcing bar.

9. A splice sleeve for connecting upper and lower reinforcing bars in a reinforced concrete construction, substantially as herein described with reference to, and as shown in, Figures 1 and 2, or Figure 5, or Figure 6, of the accompanying drawings.

10. A precast concrete building member having at least one reinforcing bar whose end is enclosed by the splice sleeve of any of the preceding Claims with its endmost portion received in the hole defined by the central radially-inwardly-projecting part, the splice sleeve being embedded in the concrete of the building member with its lower opening accessible for the insertion of a further reinforcing bar of a further building member.

11. A method of making a building construction out of reinforced concrete, comprising using the building member of Claim 10, placing the sleeve layer opening over the upper end of a lower reinforcing bar projecting from a lower building member, and injection grout into the sleeve.

12. A method of making a building construction, substantially as herein described with reference to Figure 7 of the accompanying drawings.

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